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A Study of High-Risk Drinking Patterns Among Generations Based on the 2009 Korea National Health and Nutrition Examination Survey

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Abstract

Objectives: The aim of this study was to identify how the drinking patterns of a generation on the paternal side affect those of the next generations by estimating the number of high-risk drinkers by generation according to the Alcohol Use Disorder Identification Test.

Methods: Data were selected from the 2009 Korea National Health and Nutrition Examination Survey conducted by the Korea Centers for Disease Control and Prevention and were analyzed using SPSS 18.0.

Results: Later generations started drinking earlier (62.4%, 71.8% and 91.1%, respectively). The majority of the second generation consumed more than 2–4 drinks a month (83.7%), but only a small proportion experienced difficulty in everyday life (9.6%), felt repentance (9.6%), or experienced memory loss (17.9%) after drinking. Unmarried third-generation adults with high-risk-drinking fathers reported more frequent alcohol consumption [odds ratio (OR) 1.441], greater amounts on one occasion (>7 cups for men, OR 1.661; > 5 cups for women, OR 2.078), temperance failure (OR 2.377), and repentance after drinking (OR 1.577). Unmarried third-generation adults with high-risk-drinking grandfathers consumed greater amounts of alcohol on one occasion (OR 3.642), and unmarried third-generation women more frequently consumed large amounts of alcohol (>5 cups, OR 4.091). Unmarried third-generation adults with high-risk-drinking fathers were more likely to exhibit high-risk drinking patterns (OR 1.608). Second-generation individuals from a high-risk-drinking first generation were more likely to engage in high-risk drinking (OR 3.705).

Conclusion: High-risk drinking by a generation significantly affects the high-risk drinking patterns of subsequent generations.

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1. Introduction

The 2009 Korea National Health and Nutrition Examination Survey (KNHNES) conducted by the Korea Centers for Disease Control and Prevention (KCDC) revealed rates of monthly alcohol consumption and high-risk (HR) drinking of 59.4% and 17.1%, respectively [1]. This rate of HR drinking is very high compared to the rates in Japan (12%), Italy (11.2%), Canada (9.5%), the USA (8.2%), Germany (7.9%), Australia (6.3%), France (5.3%), and Sweden (1.5%) [2]. KCDC conducted web-based research into the health-related behaviors of adolescents in 2011 and found that currently drinking students were HR drinkers or consumed HR amounts of alcohol per month (one bottle for men, >5 cups of *soju*, distilled ethanol) [3].

Korean society has taken a liberal approach to alcohol consumption by young adults, including adolescents, and to drinking patterns and drinking disorders [4,5]. It has been acknowledged that drinking patterns are hard to change, so Korean society encourages onset of drinking under the guidance of fathers or elders [6]. Therefore, the drinking patterns of fathers are related to the onset, amount, and patterns of drinking by Korean adolescents [7]. Studies on family drinking history have shown that parental drinking problems are transmitted to their children [8,9]. Some 30% of study participants were classified as children of alcoholics (COAs) in several studies on problematic children [10–12]. Adult children of alcoholics (ACOAs) are COAs who are older than 18 years and significantly involved in problematic drinking, especially in terms of amount and frequency [10,13]. From a familial perspective, the status of a drinker in a family influences the relationships in the family [14].

Many studies have investigated genetic factors in problematic drink and alcohol addiction [15–17]. A study on adult twins in Australia revealed that two-thirds of the alcoholism risk was determined by genetic effects and one-third by environmental factors [16]. Alcoholics often start with experimental drinking during adolescence, so there have been many studies on factors affecting the onset of drinking. A study of German adolescent twins and their parents showed that their drinking behaviors were more influenced by genetic and social factors or peer pressure than by parental drinking, and genetic factors were stronger for women aged 17–25 years than for men [15]. If the two factors coexisted, the children were at greater risk of alcohol dependence according to interaction between the two factors [17]. Transmission over generations was affected by genetic and psychological factors in children and siblings [18–20].

Therefore, familial factors or the drinking patterns of prior generations are strong candidates for explaining problematic drinking by subsequent generations. A few

studies on problematic drinking by college students investigated family history, parental attitudes to children's drinking, and parental drinking behaviors and frequency in Korea [21–24]. However, few study have examined factors that affect the influence of a prior generation on subsequent generations [25].

The aim of this study was to investigate generation effects on drinking patterns among three generations: the first generation, the second generation, and the unmarried third generation. The study data were sampled from 2009 KNHNES raw data, which were collected in 2009 from all of the Korean population aged ≥ 19 years by KCDC.

2. Materials and methods

2.1. Study subjects and data

The 2009 KNHNES population comprised adults aged ≥ 19 years residing in Korea. All households in sampling locations identified by local administrative units were systematically selected and enlisted. All adults in the sampled households were interviewed, which yielded a total of 227,700 interviewees. We selected 1258 households for which three generations (grandparents, parents, and unmarried adult children) resided in one household. Among the first- and second-generation individuals, women were excluded because they traditionally have very low rates of drinking in general and of HR drinking. Data were analyzed for 242 first-generation, 1232 second-generation, and 1733 third-generation (833 men, 850 women) individuals.

2.2. Study tool

Drinking-related questionnaires in the 2009 KNHNES were selected and utilized for this study. We selected as variables age, sex, and questions on current drinking status and the Alcohol Use Disorder Identification Test (AUDIT). Questions on current drinking status consisted of lifetime drinking history, onset age, current drinking, frequency, amount on one occasion, and HR drinking. The AUDIT scale of Babor et al was selected. Abstinence failures, daily life disorder, hangover, repentance, memory loss, and injury after drinking, and abstinence recommended by a doctor were included in the AUDIT questions. A score of < 8 was considered non-high-risk (NHR) drinking, and a score of ≥ 8 was defined as alcohol disorder. For the Korean standard of Lee et al, we classified 12 as the cutoff point for further analysis. The World Health Organization defines a standard drink as 12 g ($\pm 20\%$) of pure ethanol, regardless of alcohol beverage type [26]. HR drinking is classified as five or more weekly standard drinks and the limit for women is 50–80% of that for men [27]. In this study we defined HR drinking as seven cups or five cans of beer on one occasion per month for men, and five

cups or three cans of beer for women, considering the size of a cup and the ethanol content in Korea in previous studies [28]. For logistic regression analysis, drinking was defined as one cup or more per year. The onset age for drinking was classified as ≤ 20 years or ≥ 21 years and the amount on one occasion as < 5 cups or ≥ 5 cups. Answers to questions on injury after drinking and abstinence recommended by a doctor were yes or no. For comparison among generations, 0 was assigned to a score of < 8 and 1 for ≥ 8 in the AUDIT8 test, and 0 for a score of < 12 and 1 for ≥ 12 in the AUDIT12 test.

2.3. Data analysis

We used SPSS 18.0 (SPSS Inc., Chicago, IL, USA) for statistical analysis. The χ^2 test for frequency and proportion was performed to compare sociodemographic characteristics for different drinking patterns. The drinking patterns of the first and second generations were compared with those of the unmarried third generation. Simple logistic regression was conducted with drinking frequency, amount on one occasion, HR drinking, and abstinence failures as independent variables and the drinking patterns of prior generations as the dependent variable. To measure the impact of the

first generation on the second generation, HR drinkers in the first generation were assigned a value of 1 and NHR drinkers a value of 0; the same assignment was applied for the second generation. To measure the impact of the second generation on the third generation, the same values were assigned to HR and NHR drinkers for each generation.

3. Results

3.1. Demographic characteristics by generation

A total of 3207 individuals were selected: 242 men in the first generation, 1232 men in the second generations, and 1733 persons in the third generation. The average age was 79.9, 53.4, and 24.4 years for the first, second, and third generations, respectively. The third generation consisted of 883 men (51%) and 850 women (49%).

3.2. Drinking habits by generation

Table 1 shows the drinking patterns by generation. The lifetime drinking rate was 76.9%, 88.3%, and 88.0% for the first, second, and third generations, respectively. Most of the unmarried third generation began drinking at age ≤ 20 years (91.2% for men, 91.0% for women). The recent generation started drinking earlier than the

Table 1. Drinking patterns by generation

Pattern		First generation	Second generation	Unmarried third generation	
		(n = 242)	(n = 1231)	Men (n = 883)	Women (n = 850)
Lifetime drinking history	Yes	186 (76.9)	1,087 (88.3)	777 (88.0)	635 (74.7)
	No	56 (23.1)	144 (11.7)	106 (12.0)	215 (25.3)
Onset age ^a	≤ 20 yr	116 (62.4)	781 (71.8)	709 (91.2)	578 (91.0)
	≥ 21 yr	70 (37.6)	306 (28.2)	68 (8.8)	57 (9.0)
Current drinking ^a	Yes	116 (62.4)	989 (91.0)	734 (94.5)	589 (92.8)
	No	70 (37.6)	98 (9.0)	43 (5.5)	46 (7.2)
Frequency ^b	< 2 a month	41 (35.3)	161 (16.3)	235 (32.0)	345 (58.6)
	≥ 2 a month	75 (64.7)	828 (83.7)	499 (68.0)	244 (41.4)
Amount on one occasion ^b	< 5 cups	84 (72.4)	347 (35.1)	254 (34.6)	386 (65.5)
	≥ 5 cups	32 (27.6)	642 (64.9)	480 (65.4)	203 (34.5)
High-risk drinking ^b	< 1 a month	87 (75.0)	355 (35.9)	335 (45.7)	414 (70.3)
	≥ 1 a month	29 (25.0)	634 (64.1)	398 (54.3)	175 (29.7)
Abstinence failures ^b	< 1 a month	109 (94.0)	834 (84.3)	684 (93.3)	570 (96.8)
	≥ 1 a month	7 (6.0)	155 (15.7)	49 (6.7)	19 (3.2)
Daily life disorder after drinking ^b	< 1 a month	113 (97.4)	894 (90.4)	693 (94.4)	573 (97.3)
	≥ 1 a month	3 (2.6)	95 (9.6)	41 (5.6)	16 (2.7)
Hangover after drinking ^b	< 1 a month	112 (94.4)	960 (97.1)	720 (98.1)	586 (99.5)
	≥ 1 a month	4 (6.0)	29 (2.9)	14 (1.9)	3 (.5)
Repentance after drinking ^b	< 1 a month	109 (94.8)	811 (82.1)	654 (89.1)	553 (93.9)
	≥ 1 a month	7 (5.2)	117 (17.9)	80 (10.9)	36 (6.1)
Memory loss after drinking ^b	< 1 a month	110 (94.8)	888 (89.8)	705 (96.0)	574 (97.5)
	≥ 1 a month	6 (5.2)	101 (10.2)	29 (4.0)	15 (2.5)
Injury after drinking ^a	No	173 (93.5)	1034 (95.3)	754 (97.2)	620 (97.6)
	Yes	12 (6.5)	51 (4.7)	22 (2.8)	15 (2.4)
Abstinence recommended by doctor ^a	No	139 (75.1)	725 (66.8)	678 (87.4)	603 (95.0)
	Yes	46 (24.9)	360 (33.2)	98 (12.6)	32 (5.0)

^aAmong those with a lifetime history of drinking; ^bAmong those who currently drink. Data are presented as n (%).

previous generation. The current rate of drinking was 62.4%, 91.0%, 94.5%, and 92.8% for the first and second generations and third-generation men and women, respectively. The corresponding results for those consuming two or more drinks a month among current drinkers was 64.7%, 83.7%, 68.0%, and 34.5%, so the second generation and third-generation men drank the most. HR drinking was reported for 25.0% of the first generation, 64.1% of the second, and 54.3% of men and 29.7% of women in the third generation, so the second generation had the highest rate. More than one abstinence failures (15.7%), daily life disorder after drinking (9.6%), repentance after drinking (17.9%), and memory loss (10.2%) were highest for the second generation. Abstinence recommended by a doctor was highest for the second generation (33.2%), followed by the first generation (24.9%) and unmarried men in the third generation (12.6%).

3.3. Comparison of drinking patterns among generations

3.3.1. Comparison of the second and third generations

Drinking patterns for the third generation according to those of the second generation are shown in Table 2. A

significantly higher proportion of third-generation individuals with a HR-drinking father drank more frequently, drank a greater amount on one occasion, and engaged in HR drinking. The proportion of the third generation who drank twice or more a month was 42.5% and 51.6% for those with NHR and HR fathers, respectively ($p < 0.001$). Consumption of \geq five cups on one occasion by the third generation significantly differed by father's HR drinking status (38.6% for NHR vs 47.9% for HR, $p < 0.001$). The same was true for HR drinking proportions among men (55.6%) and women (30.0%) of the third generation ($p < 0.001$), abstinence failures (2.5% for NHR vs 6.5% for HR, $p < 0.001$), and repentance after drinking (6.0% for NHR vs 9.1% for HR, $p < 0.030$). However, there were no significant differences for daily life disorder after drinking, hangover, memory loss, and injury after drinking, abstinence recommended by a doctor, and AUDIT8 and AUDIT12 scores.

3.3.2. Comparison of the first and third generations

The drinking patterns of the third generation by that of the first generation were similar. The proportion of third-generation individuals with HR-drinking grandfathers was higher for frequency of consumption, amount on one occasion, and HR drinking (Table 3). There were

Table 2. Drinking patterns for the third generation according to drinking risk for the second generation

Pattern		Second generation		χ^2	<i>p</i>
		NHRD (<i>n</i> = 738)	HRD (<i>n</i> = 583)		
Frequency	≤ 1 a month	424 (57.5)	282 (48.4)	10.797	0.001
	≥ 2 a month	314 (42.5)	301 (51.6)		
Amount on one occasion	≤ 4 cups	453 (61.4)	304 (52.1)	11.361	0.001
	≥ 5 cups	285 (38.6)	279 (47.9)		
Frequency of ≥ 7 cups (men)	≤ 1 a month	210 (57.1)	136 (44.4)	10.652	0.001
	≥ 2 a month	158 (42.9)	170 (55.6)		
Frequency of ≥ 5 cups (women)	≤ 1 a month	306 (82.9)	194 (70.0)	15.030	0.000
	≥ 2 a month	63 (17.1)	83 (30.0)		
Fail to abstinence	≤ 1 a month	716 (97.2)	545 (93.5)	10.260	0.001
	≥ 2 a month	21 (2.8)	38 (6.5)		
Daily life disorder after drinking	≤ 1 a month	718 (97.3)	556 (95.4)	3.503	0.061
	≥ 2 a month	20 (2.7)	27 (4.6)		
Hangover with a drink	≤ 1 a month	732 (99.2)	575 (98.6)	0.971	0.324
	≥ 2 a month	6 (0.8)	8 (1.4)		
Repentance after drinking	≤ 1 a month	694 (94.0)	530 (90.9)	4.686	0.030
	≥ 2 a month	44 (6.0)	53 (9.1)		
Memory loss after drinking	≤ 1 a month	724 (98.1)	563 (96.6)	3.055	0.081
	≥ 2 a month	14 (1.9)	20 (3.4)		
Injury after drinking	No	720 (97.6)	569 (97.8)	0.060	0.807
	Yes	18 (2.4)	13 (2.2)		
Abstinence recommended by doctor	No	675 (91.5)	534 (91.8)	0.035	0.851
	yes	63 (8.5)	48 (8.2)		
AUDIT(8-point scale)	Non-problematic (< 8)	627 (85.2)	459 (84.9)	0.021	0.886
	Problematic (≥ 8)	109 (14.8)	88 (15.1)		
AUDIT(12-point scale)	Non-problematic (< 12)	674 (91.6)	528 (90.6)	0.411	0.522
	Problematic (≥ 12)	62 (8.4)	55 (9.4)		

Data are presented as *n* (%). HRD = high-risk drinking; NHRD = non-high-risk drinking.

Table 3. Drinking patterns for the third generation according to drinking risk for the first generation

Pattern		First generation		χ^2	<i>p</i>
		NHRD (<i>n</i> = 130)	HRD (<i>n</i> = 28)		
Frequency	≤1 a month	78 (60.0)	13 (46.4)	1.737	0.187
	≥2 a month	52 (40.0)	15 (53.6)		
Amount on one occasion	≤4 cups	37 (66.9)	10 (35.7)	9.467	0.002
	≥5 cups	43 (33.1)	18 (64.3)		
Frequency of ≥ 7 cups (men)	≤1 a month	34 (57.6)	7 (50.0)	0.267	0.605
	≥2 a month	25 (42.4)	7 (50.0)		
Frequency of ≥5 cups (women)	≤1 a month	60 (84.5)	8 (57.1)	5.473	0.019
	≥2 a month	11 (15.5)	6 (42.9)		
AUDIT(8-point scale)	Non-problematic (<8)	105 (81.4)	24 (85.7)	0.293	0.588
	Problematic (≥8)	24 (18.6)	4 (14.3)		
AUDIT(12-point scale)	Non-problematic (<12)	117 (90.7)	26 (92.9)	0.132	0.716
	Problematic (≥12)	12 (9.3)	2 (7.1)		

Data are presented as *n* (%). HRD = high-risk drinking; NHRD = non-high-risk drinking.

significant differences in consumption of ≥ five cups on one occasion (33.1% for NHR vs 64.3% for HR first generation, $p < 0.002$). Consumption of ≥ five cups on one occasion also significantly differed among third-generation women (15.5% for NHR vs 42.9% for HR first generation, $p < 0.019$). However, there were no significant differences in AUDIT8 and AUDIT12.

3.4. Relationship between drinking patterns for prior generations and the third generation

Table 4 shows the relation between the drinking patterns of prior generations and those of the third generation. The drinking patterns of the third generation were significant only for the amount on one occasion and HR drinking by women. Third-generation individuals with HR-drinking grandfathers were 3.64 times more likely to drink ≥ five cups on one occasion ($p < 0.003$) and third-generation women were 4.09 times more likely to engage in HR drinking ($p < 0.026$). Third-generation individuals with a HR-drinking father were 1.44 times more likely to consume two or more drinks per month ($p < 0.001$) and 1.46 times more likely to consume ≥ five cups on one occasion ($p < 0.001$). Third-generation men and women were 1.66 times and 2.08 times more likely, respectively, to engage in HR drinking (both $p < 0.001$). Abstinence failures and repentance after drinking were 2.38 times ($p < 0.002$) and 1.58 times more likely, respectively, in third-generation individuals with HR-drinking fathers ($p < 0.032$). However, there were no significant differences in AUDIT8 and AUDIT12 scores.

3.5. Impact of previous generations on HR drinking by the next generation

HR drinking by the second generation was associated with HR drinking by the first generation. Likewise, HR drinking by the third generation was related to HR drinking by the second generation. However, there was

no relation between HR drinking by the first and third generations (Table 5). For first-generation HR drinkers, their offspring were 3.71 times more likely to be HR drinkers ($p < 0.006$). For second-generation HR drinkers, their offspring were 1.61 times more likely to be HR drinkers ($p < 0.002$). Although the probability of being a third-generation HR drinker was 1.67 times greater for those with a HR-drinking grandfather, the difference was not statistically significant. Therefore, a prior generation had a greater impact on HR drinking by its immediate offspring.

4. Discussion

HR drinking by the second generation was serious in this study. The rate of HR drinking in KNHNES was also higher for this cohort, at 29.9% for those in their 40s and 30.0% for those in their 50s [1], in accordance with our results. However, we defined HR drinking on a monthly basis, so that the rate of HR drinking was higher than that in the KNHNES results. The rate of HR drinking in Korea is notable, because young adults (18–29 years) in the USA constitute only a quarter of the adult population but account for nearly 50% of the alcohol consumption [29]. In Korea, men in their 40s and 50s are socially active, so the number of injuries caused by drinking was highest among men in their 40s [4]. Drinking by the elderly damages their health because of their low metabolism and interactions with medicines for non-communicable diseases, so the current rate of HR drinking was considered to be relatively low in this study.

HR drinking by the second generation led to higher probability of consumption of more drinks, greater drinking frequency, consumption of greater amounts on one occasion, and HR drinking (Table 5). The probability of HR drinking by third-generation woman was

Table 4. Drinking patterns for the third generation according to drinking risk for previous generations

Pattern		First generation (<i>n</i> = 242)		Second generation (<i>n</i> = 1232)	
		OR (95% CI)	<i>p</i>	OR (95% CI)	<i>p</i>
Frequency	≤1 a month	1	0.191	1	0.001
	≥2 a month	1.73 (0.76–3.94)		1.44 (1.16–1.80)	
Amount on one occasion	≤4 cups	1	0.003	1	0.001
	≥5 cups	3.64 (1.55–8.57)		1.46 (1.17–1.82)	
Frequency of ≥7 cups (men)	≤1 a month	1	0.606	1	0.001
	≥2 a month	1.36 (0.42–4.37)		1.66 (1.22–2.26)	
Frequency ≥5 cups (women)	≤1 a month	1	0.026	1	0.000
	≥2 a month	4.09 (1.186–14.11)		2.08 (1.43–3.02)	
Abstinence failures	≤1 a month			1	0.002
	≥2 a month			2.38 (1.38–4.10)	
Daily life disorder after drinking	≤1 a month			1	0.064
	≥2 a month			1.74 (0.97–3.14)	
Hangover with a drink	≤1 a month			1	0.330
	≥2 a month			1.70 (0.59–4.92)	
Repentance after drinking	≤1 a month			1	0.032
	≥2 a month			1.58 (1.04–2.39)	
Memory loss after drinking	≤1 a month			1	0.085
	≥2 a month			1.84 (0.92–3.67)	
Injury after drinking	No			1	0.807
	Yes			0.91 (0.44–1.88)	
Abstinence recommended by doctor	No			1	0.851
	Yes			0.96 (0.65–1.43)	
AUDIT (8-point scale)	Non-problematic (<8)	1	0.590	1	0.886
	Problematic (≥8)	0.73 (0.23–2.30)		1.02 (0.75–1.39)	
AUDIT(12-point scale)	Non-problematic (<12)	1	0.717	1	0.522
	Problematic (≥12)	0.75 (0.16–3.56)		1.13 (0.77–1.66)	

Odds ratios calculated using the non-high-risk group in the relevant generation as a reference. CI = confidence interval; OR = odds ratio.

2.08 times higher ($p < 0.001$). This result is in agreement with previous studies on children who have parents with problematic drinking [13,30].

The drinking patterns of the first generation influenced the third generation, but the magnitude of the

impact on the third generation was less than that on the second generation (Tables 4 and 5). HR drinking by the second generation influenced that of the third generation ($p < 0.002$), but the influence of the first generation on the third generation was relatively lower (Table 5).

Table 5. Impact of prior generations on subsequent generations

	OR (95% CI)	<i>p</i>
Second generation		
Non-high-risk first generation	1	0.006
High-risk first generation	3.71 (1.47–9.37)	
Third generation		
Non-high-risk first generation	1	0.400
High-risk first generation	1.67 (0.53–5.31)	
Non-high-risk second generation	1	0.002
High-risk second generation	1.61 (1.18–2.19)	

CI = confidence interval; OR = odds ratio.

Interestingly the impact of the first generation on the second generation was lower than the impact of the second generation on the third generation (Table 5). This suggests that the generation effect might be weakened. This is useful in understanding the association between genetic and environmental factors [31].

An interesting result is the lack of significant differences in alcoholic disorder among the generations according to both AUDIT8 and AUDIT12, despite differences in drinking patterns (Tables 2, 3, and 4). In Koreans, drinking has been characterized as excessive and social, but not alcoholism [4], so our results are in agreement with a previous study on alcoholic disorder. Thus, drinking problems exhibited by Koreans are not related to genetics but to familial environment. If parents take a permissive attitude to the children, the onset age and rate of drinking among adolescents were higher in previous studies [32,33]. This is why the second generation had a greater impact on the third generation than the first generation did in this study (Tables 4 and 5). A liberal drinking attitude has been passed down through the generations in family units in Korean society [4]. Drinking problems exhibited by Koreans are not entirely dominated by environmental factors, but they could be a predominant factor. Alcohol-related problems in Korea have become serious in terms of their number, variety, and magnitude [34]. It is necessary to develop a program to block the generation effect in the liberal and permissive drinking environment in Korean society.

KNHNES was a cross-sectional survey, so we did not examine drinking causes and prognosis in this study. Environmental and genetic factors were also not included, although they have been discussed in previous studies. In addition, we did not include women in the first and second generations.

We suggest that education of adolescents, including college students, is necessary because the frequency of drinking was high in those with an onset age of ≤ 20 years. Abstinence education programs should also be run for middle-aged men. Education programs for family units are necessary because high-risk drinking by a prior generation leads to similar behavior in the next generation.

Conflicts of interest

All contributing authors declare no conflicts of interest.

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